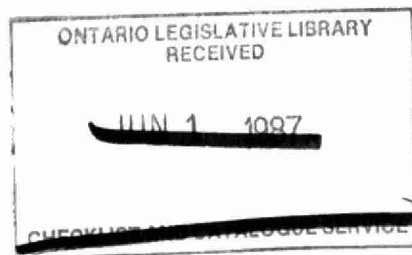


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AIR QUALITY ASSESSMENT
THUNDER BAY TERMINALS LTD.
THUNDER BAY
1975

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SUMMARY

A pre-operational vegetation and soil sampling survey in the vicinity of a proposed coal storage terminal on McKellar Island, Thunder Bay harbour, has shown that levels of aluminum, arsenic and iron were within ranges considered normal. Snow samples collected in early 1975 were, however, contaminated with arsenic and iron near iron pellet piles at the terminal operated by Valley Camp Ltd. on the mainland south of Mission River.

Dustfall near coal piles at Ontario Hydro's Mission Island generating station was often above the provincial criterion, but suspended particulate levels were generally low.

INTRODUCTION

In 1975, the Ontario Ministry of the Environment began air assessment investigations in the vicinity of three industries situated in close proximity to each other near the mouth of the Kaministiquia River in Thunder Bay harbour. Snow sampling studies were conducted in January and March, and results were evaluated in an earlier report. Beginning in April, dustfall and suspended particulate measurements were undertaken by V. B. Cook Co. Ltd., project managers for Thunder Bay Terminals Ltd. A phytotoxicology survey was carried out on July 2-3, 1975, by the Ministry of the Environment to determine pre-operational conditions prior to the scheduled 1977 start-up of the coal storage terminal. The survey was also designed to determine the effects, if any, of existing industries on vegetation and soil in the same area.

METHODS

Trembling aspen foliage and soil (0-10 cm) were collected from 21 sites in the study area (Figure 1), including three on McKellar Island, seven near Valley Camp Ltd., four near coal piles at the Ontario Hydro station on Mission Island and seven along railway lines approaching the river mouth area. Control samples were obtained at the locations remote from the study area. Vegetation was assessed for insect and/or disease injury and for evidence of visible effects from air pollutants. All samples were analysed for aluminum, arsenic, and iron. Aluminum and iron occur at significant levels in coal, and iron and arsenic contamination is associated with the transfer and storage of iron ore pellets (Valley Camp).

Dustfall and suspended particulate measurements were carried out by V. B. Cook Ltd. using standard sampling devices. Values for suspended particulate were obtained with high-volume air samplers at four sites, and all instruments were operated for a 24-hour period every sixth day. The first exposure date was March 26. Dustfall at seven locations was measured at monthly intervals, beginning in May. The arrangement of air monitoring sites is shown in Figure 2.

RESULTS

(a) Vegetation and Soil Sampling

No visible vegetation injury attributable to air pollutants was observed in the vicinity of the industries investigated. Foliage diseases caused by infection by a leaf spot fungus (Marssonina populi) and powdery mildew (Microsphaera alni) were noted on balsam poplar and speckled alder, respectively, in a localized area about 100 metres north of coal piles at the Ontario Hydro station.

About a week after the survey was completed, a small area (1.3 ha) of vegetation injury, caused by sulphur dioxide, was encountered on the north bank of Mission River, opposite Valley Camp's dock area. Although the SO₂ source was never determined with certainty, there was no evidence that emissions from local industry were responsible.

Chemical analysis results are summarized in Table 1. Arsenic concentrations in trembling aspen were found to be uniformly low at all sites. Foliar levels of aluminum and iron were generally higher in the study area than at the control points, but no levels were considered excessive and there was little evidence of concentration gradients around known sources. Arsenic in soil was usually at or below the mean of 10 ppm for uncontaminated Ontario soils. A few elevated levels were encountered but these were not excessive nor were they associated with known sources. Aluminum and iron concentrations averaged 1.7% (range 1.1-2.2%) and 3.6% (range 2.0-8.7%), respectively, for soils in the survey area. No relationship was apparent between concentrations and distance from a known source.

(b) Air Monitoring

Values for dustfall and suspended particulate are given in Tables 2 and 3, respectively. Dustfall frequently exceeded the Ontario criterion of 20 tons/square mile/30 days at sites near Ontario Hydro's coal piles (stations 4-7, Table 2). Spring and early summer levels were generally higher than those in the autumn and early winter, a trend which has been

observed in the Thunder Bay area for several years. Visual observations of dustfall jar contents indicated that coal dust constituted much of the material deposited near Ontario Hydro's coal piles. Jars exposed in spring and early summer also contained quantities of sandy material, probably from re-entrainment of ground-level dust in the vicinity. Suspended particulate levels exceeded the Ontario criterion of $120 \mu\text{g}/\text{m}^3$ for about 6 percent of the sampling period. No levels were considered excessive, and all were within the range normally expected in the Thunder Bay area.

DISCUSSION AND CONCLUSIONS

A pre-operational vegetation and soil assessment survey in the vicinity of a proposed coal storage facility on McKellar Island has revealed that levels of aluminum, arsenic and iron were not excessive. Some of the moderately elevated concentrations of arsenic near railway lines (station 18, 19 and 22) may be attributable to former coal transport operations. In an earlier study, snow samples collected in close proximity to the project site were analysed for aluminum, arsenic, calcium, carbon, chloride, iron, sodium, sulphate and zinc. Concentrations of all these elements were low on McKellar Island but iron and arsenic contamination was found in snow near Valley Camp's operation on the mainland south of Mission River.

Dustfall near Ontario Hydro was frequently in excess of the Ontario criterion, and most of this deposition was attributed to coal dust. As expected, highest values were recorded in spring and early summer. Most suspended particulate concentrations were low.

Based on results obtained in 1975, it is recommended that further vegetation and soil sampling be discontinued until the coal storage facility is operational. Monitoring of dustfall and suspended particulate should continue and these surveys should be supported by measurements of wind direction. Additional air monitoring sites might be considered at the outskirts of the city along rail lines over which coal will be carried to the terminal.

TABLE 1. Levels of aluminum, arsenic and iron in trembling aspen foliage and soil in the vicinity of Thunder Bay Terminals Ltd., July 2-3, 1975.*

Area	Station number	Trembling aspen			Soil (0-10 cm)		
		Al	As	Fe	Al(%)	As	Fe(%)
Valley Camp	7	53	<0.3	165	1.8	24	3.0
	8	80	0.5	427	1.8	13	3.2
	9	60	0.4	410	1.4	4	2.4
	10	37	0.3	157	1.5	4	2.2
	11	60	<0.3	173	1.1	3	2.0
	16	63	<0.3	207	1.5	5	2.3
Ontario Hydro	2	40	0.5	97	1.7	11	5.0
	3	53	0.3	137	2.1	18	7.2
	4	90	0.3	230	2.2	24	8.7
	5	50	<0.3	123	1.8	4	3.2
Thunder Bay Terminals	6	23	<0.3	100	1.2	10	2.3
	15	-	-	-	1.2	11	3.8
City and Railway Lines	1	153	0.7	487	1.4	7	2.4
	14	113	0.3	380	1.9	7	3.4
	17	53	0.5	143	1.9	5	3.1
	18	73	<0.3	156	1.5	34	2.3
	19	60	<0.3	187	2.0	24	4.5
	20	57	<0.3	220	2.1	4	3.5
	21	33	<0.3	170	1.4	5	2.9
	22	77	<0.3	333	1.4	28	5.0
	23	173	0.4	680	1.5	8	2.8
Controls	12	37	<0.3	70	2.2	5	3.2
	13	23	<0.3	60	1.7	-	2.2

* Values are in ppm, dry weight, except where otherwise noted, and are averages of triplicate samples.

TABLE 2. Dustfall (tons/sq.mi./30 days) in the vicinity of Thunder Bay Terminals and Ontario Hydro, 1975.

Station Number	Location	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
1	Sewage treatment plant	10	13	12	7	-	11	12	6	10
2	Shell Oil	15	<u>26</u> *	16	8	-	16	13	6	14
3	Thunder Bay Terminals	8	-	10	9	-	-	11	5	9
4	Ontario Hydro (SE)	<u>34</u>	<u>25</u>	<u>31</u>	10	-	8	16	6	19
5	Ontario Hydro (SW)	16	<u>44</u>	<u>25</u>	-	-	-	17	9	22
6	Ontario Hydro (NW)	<u>88</u>	<u>21</u>	<u>23</u>	<u>22</u>	-	19	18	6	28
7	Ontario Hydro (NE)	<u>75</u>	<u>37</u>	-	<u>58</u>	-	<u>60</u>	5	<u>42</u>	46

* Values above Ontario ambient air criterion of 20 tons/sq.mi./30 days are underlined.

TABLE 3. Suspended particulate ($\mu\text{g}/\text{m}^3$) in the vicinity of Thunder Bay Terminals Ltd., 1975. Levels over 120 μg are underlined.

Date	Sampling Site*				Sampling Site		
	1	2	3		1	2	3
26.3.75	30	14	-	4.8.75	25	34	8
				10.8.75	29	54	31
2.4.75	4	22	38	16.8.75	33	58	32
6.4.75	24	40	13	22.8.75	28	55	26
12.4.75	66	-	-	28.8.75	15	66	5
18.4.75	19	-	-				
24.4.75	35	-	-	3.9.75	-	34	-
29.4.75	26	52	45	9.9.75	-	101	-
				15.9.75	-	-	-
6.5.75	58	61	43	21.9.75	14	61	26
12.5.75	59	<u>287</u>	97	27.9.75	74	<u>126</u>	67
18.5.75	48	<u>84</u>	55				
24.5.75	43	91	49	3.10.75	68	80	34
30.5.75	48	86	39	9.10.75	18	24	16
				15.10.75	13	15	9
5.6.75	22	39	20	21.10.75	78	<u>136</u>	<u>209</u>
11.6.75	33	<u>137</u>	33	27.10.75	110	-	<u>82</u>
17.6.75	51	<u>244</u>	59				
23.6.75	42	<u>110</u>	41	2.11.75	63	115	68
29.6.75	36	32	25	8.11.75	54	96	47
				14.11.75	76	122	61
5.7.75	43	73	58	20.11.75	30	52	5
11.7.75	43	53	46	26.11.75	30	38	32
17.7.75	83	<u>123</u>	63				
23.7.75	47	<u>67</u>	46	2.12.75	22	24	22
29.7.75	<u>155</u>	93	52	8.12.75	50	39	44
				14.12.75	18	20	19
				20.12.75	19	30	20
				26.12.75	20	21	22

* Sites 1, 2 and 3 are located at the Sewage Treatment Plant, Shell Oil and Thunder Bay Terminals, respectively.

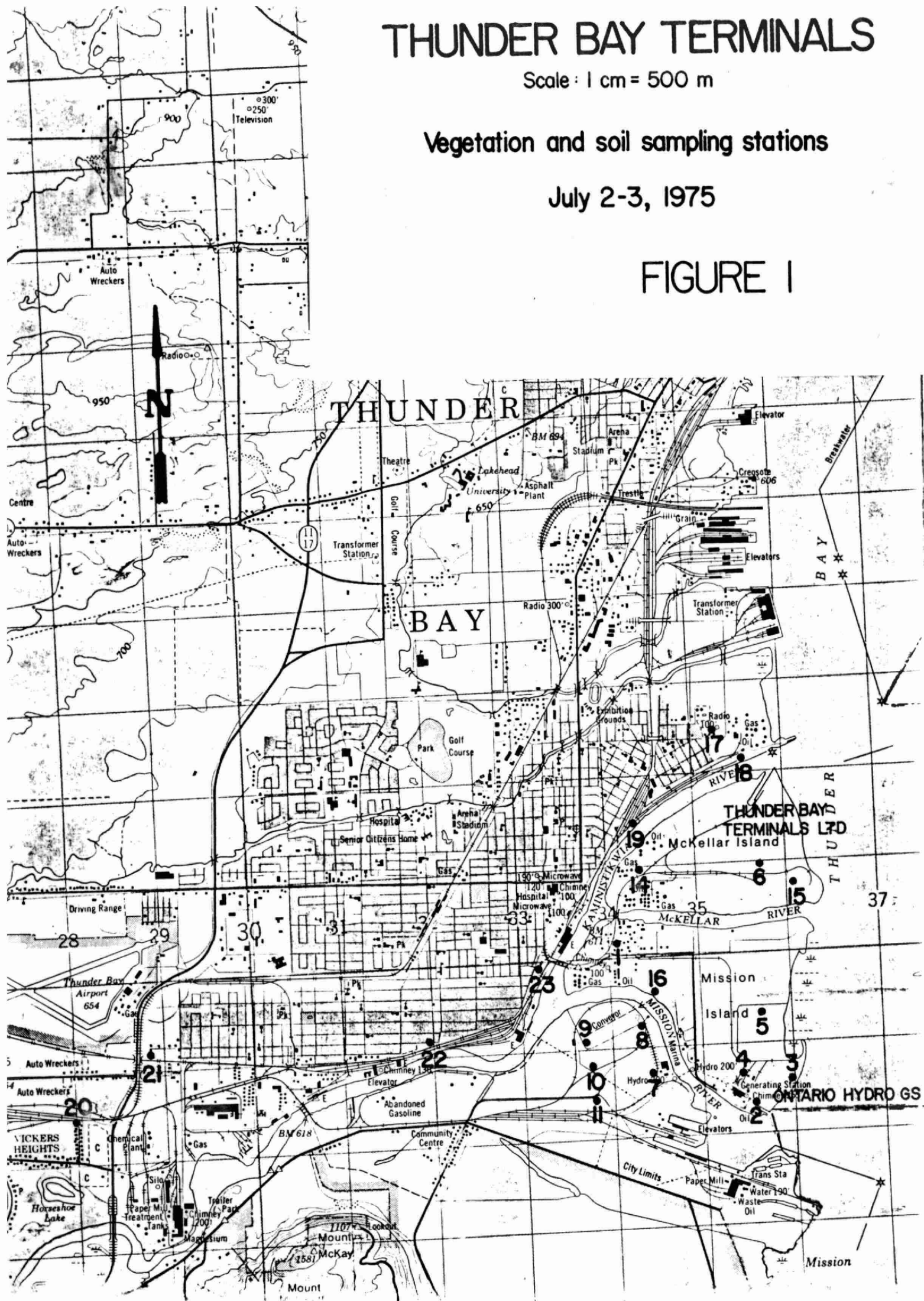
THUNDER BAY TERMINALS

Scale : 1 cm = 500 m

Vegetation and soil sampling stations

July 2-3, 1975

FIGURE 1



THUNDER BAY TERMINALS

Scale: 1 cm = 200 m

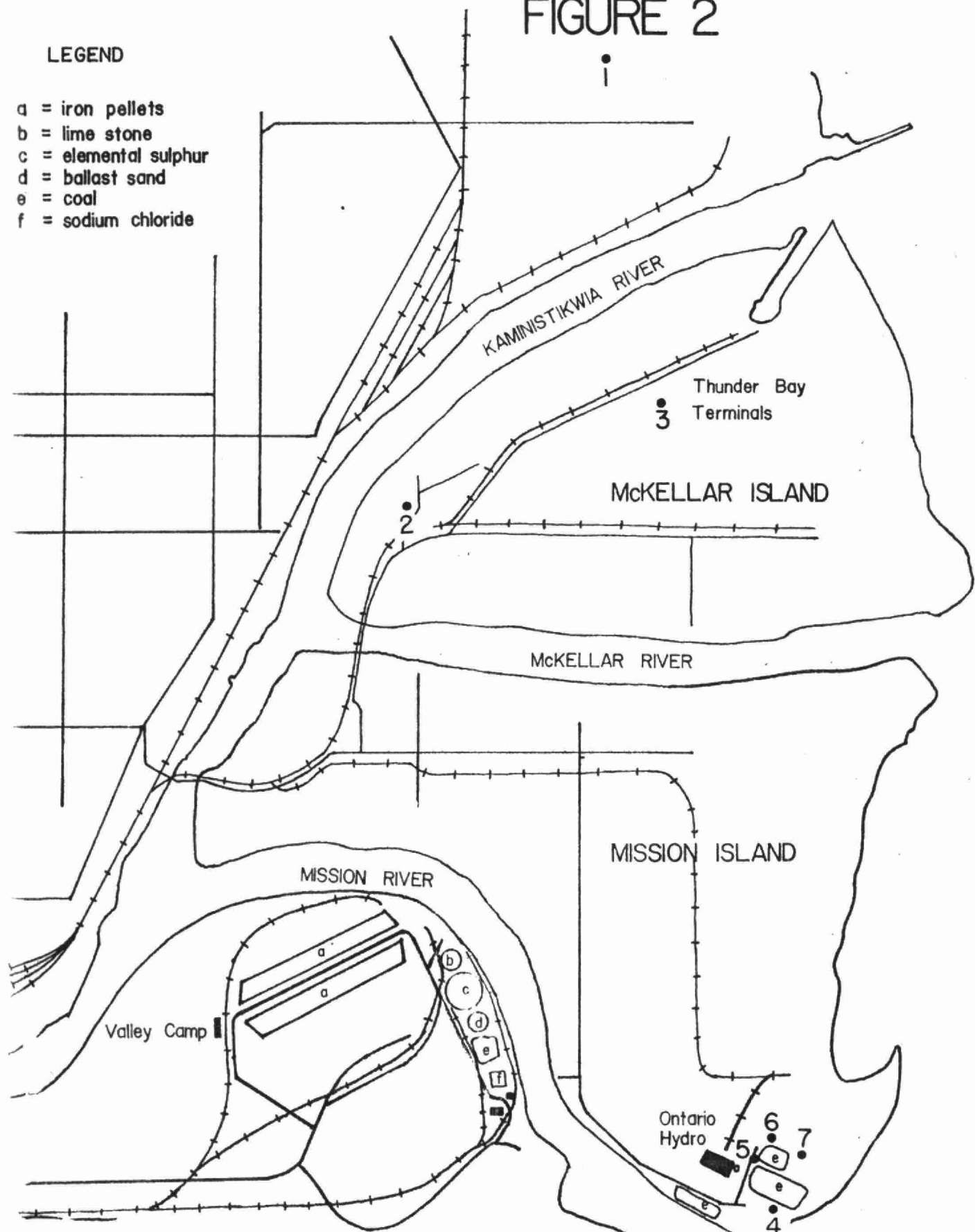
Air monitoring sites

1975

FIGURE 2

LEGEND

- a = iron pellets
- b = lime stone
- c = elemental sulphur
- d = ballast sand
- e = coal
- f = sodium chloride



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